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INOCULATION OF MONKEYS WITH PELLAGROUS BLOOD AND SERUM, AND THE OCCURRENCE OF B. MAYDIS IN PELLAGRA.

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The investigation into the etiology of pellagra as it occurred in the Cook County Institutions was directed toward determining:

- (1) The infectivity of the blood of pellagrins for the monkey.
- (2) The toxicity of the blood of pellagrins for the monkey.
- (3) The bacteria associated with pellagra.

INFECTIVITY OF THE BLOOD OF PELLAGRINS FOR THE MONKEY.

Monkey 1.—Received subcutaneously 5 c.c. of defibrinated blood obtained the same day from a very severe case of pellagra which terminated fatally the following day. The monkey remained well as long as it was kept under observation (about three months). During the first month the temperature was taken twice daily and showed no change from the controls taken on the days previous to the injection.

Monkey 2.—The femoral vein was isolated, and 10 c.c. of blood, removed from the median basilic vein of a well-marked case of pellagra, were injected before clotting occurred. The wound was sutured and healed by primary intention. The monkey remained healthy.

THE TOXICITY OF THE SERUM OF PELLAGRINS FOR THE MONKEY.

Monkey 3.—Serum, obtained from a patient with pellagra preparatory to transfusion, was injected subcutaneously in 5 c.c. doses on alternate days. The serum was preserved in the ice box and kept sterile. The monkey received in all 60 c.c. of serum given in a period of 24 days. No change in temperature was observed, but the monkey became emaciated and died one week after the last injection. No symptoms, commonly considered characteristic of pellagra, developed. The autopsy showed an atrophy of the organs without marked degeneration. The brain and cord were somewhat softer than normal, and examination of

the cord showed marked chromatolysis of the ganglion cells of the anterior horns. Hemolysins and precipitins for normal human serum did not develop. Cultures from the heart's blood and peritoneal fluids were sterile.

Monkey 4.—Given 200 c.c. of serum obtained from a case of pellagra with well-marked skin lesions but in good general condition. The serum was given in 10 c.c. doses on alternate days. The monkey remained healthy.

Monkey 5. (Control).—Received injections as in the case of monkey 4, except that serum, obtained from a bleeding of a patient dying of uremia, was used. This monkey also remained healthy.

BACTERIA ASSOCIATED WITH PELLAGRA.

Bacteriologic examinations of the stools, skin lesions, mouth lesions, and blood were made. The blood in the few cases examined was sterile. The mouth and skin lesions yielded no special results, the common pus-forming cocci being the usual organisms present.

The stools of a number of cases of pellagra were examined as follows: The stools were taken to the laboratory in sterile test tubes and plated on litmus lactose agar as soon as possible. After 24 hours' incubation, subcultures of colonies, which did not resemble those of the colon bacillus, were made and the cultural characteristics tabulated. Control cultures were made from patients with diarrhea without pellagra.

In this way the bacterial flora of the stools of 20 cases of pellagra were compared with 25 cases of dysentery without pellagra.

Of the large number of bacteria isolated, only one organism was found to be present in more than one pellagrin and absent in the control cases. This organism was found in nine cases of pellagra. The organism is a motile, gram-positive bacillus resembling the anthrax bacillus in shape and size. It grows profusely on ordinary media with the formation of slimy opaque white colonies with a fairly sharp border. Gelatin stab cultures are liquefied in the shape of a cup at the top of the stab in about one week. Central spores are formed. The organism does not ferment dextrose, lactose, nor mannite. Milk remains fluid.

This description corresponds to that of *B. maydis*—an organism

found associated with pellagra by Majocchi,¹ Cuboni,² Paltauf and Heider.³

Macroscopic agglutination tests were made with the serums of seven cases of pellagra, in every case using a strain of bacilli isolated from another patient. This was thought desirable in order to exclude the possibility that the organism was simply accidentally present and caused the formation of agglutinins, although having no connection with the disease. In every case tested, agglutination occurred. The dilutions were as follows: Five cases agglutinated at 1-10, two cases at 1-20. The tubes were allowed to stand for four hours in the incubator and 12-18 hours in the ice box. The organism was not agglutinated except in dilutions of 1-2, by normal serum.

With one exception subcutaneous injections of one half and of one agar slant were harmless to rabbits and guinea-pigs. In the one exception, a rabbit which died in 12 hours, the organs showed only a severe congestion. Although an attempt to isolate a contaminating organism was negative, it is probable that death was caused in this way.

A macacus monkey was fed on bread upon which the bacillus was allowed to grow for 24-48 hours and the feeding continued over a period of six months. The monkey remained healthy and at no time exhibited any gastro-intestinal symptoms.

In three cases of pellagra with dysentery, Shiga bacilli were found. In two cases of pellagra and Shiga bacillus dysentery, the dysentery improved under vaccine treatment, using killed Shiga bacilli, without any effect upon the skin lesions of the patient.

Vaccine treatment with *B. maydis* gave a questionable result in the one case in which it was tried. The patient improved for a time, but later became worse and died. The vaccine was not used in the relapse, owing to the apparent severity of the intoxication.

SUMMARY AND CONCLUSIONS.

The experiments described failed to demonstrate any infectiousness of the blood of pellagrins for the monkey.

¹ Quoted by Sambon, *Brit. Med. Jour.*, 1905, 2, p. 1272.

² *Arch. di Psichiat.*, 1882, 3, p. 353.

³ *Med. Jahrb.*, 1888, 3, p. 383.

In one case the blood of a pellagrin was toxic for the monkey. It is possible, however, that this toxicity was not due to the same toxic agent that was responsible for the symptoms of pellagra.

It is difficult to draw any conclusions from the bacteriological findings. Raubitchek¹ found *B. mesentericus*, an organism closely resembling *B. maydis* culturally, in the stools of pellagrins but found it as well in non-pellagrous control cases. The results of agglutination tests would indicate that the organism was etiologically connected with the disease. Attempts to produce pellagra with it failed in monkeys.

¹ *Wien. klin. Wochenschr.*, 1910, 23, p. 963.